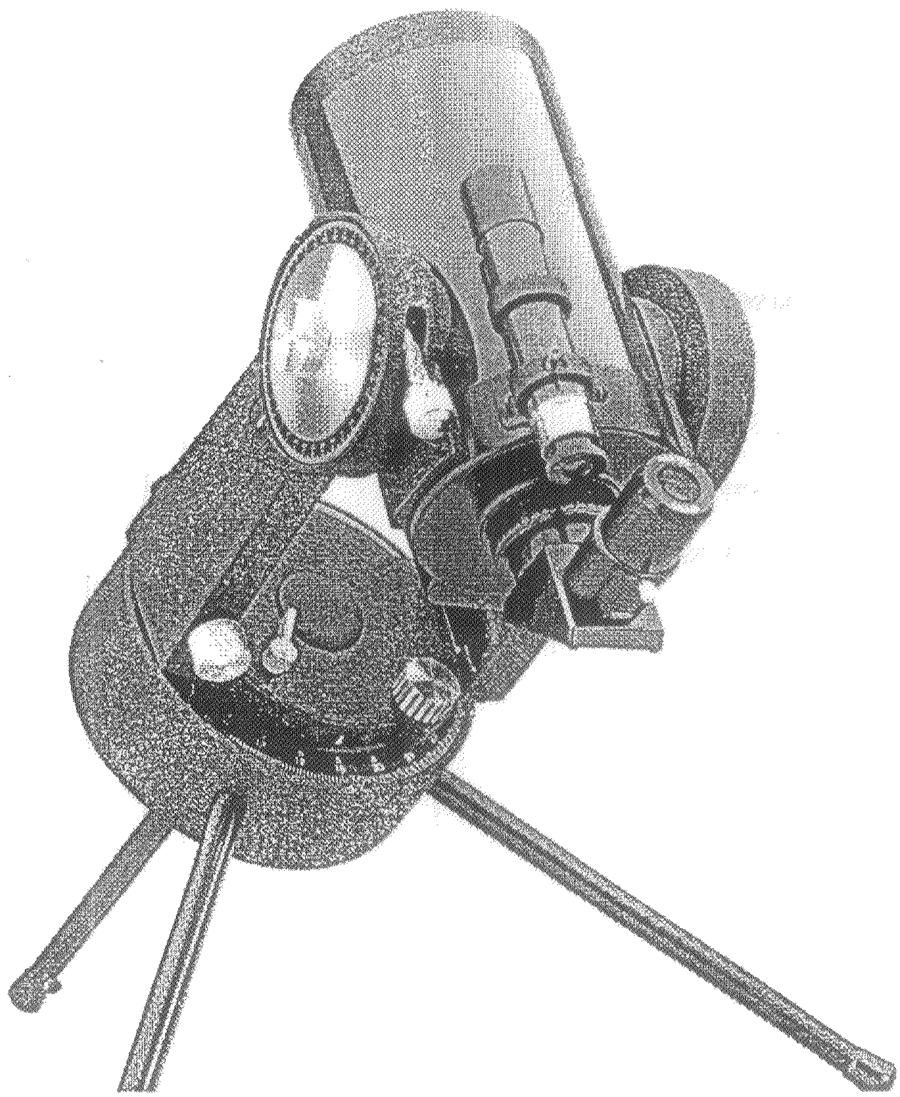
# OPERATING INSTRUCTIONS

## MEADE MODEL 2045

## 4" SCHMIDT-CASSEGRAIN TELESCOPE



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# MEADE MODEL 2045: 4" SCHMIDT-CASSEGRAIN TELESCOPE

## INTRODUCTION

The Meade Model 2045 permits a very wide range of serious astronomical and terrestrial applications — and in an extremely compact and portable optical/mechanical package. The advanced Schmidt-Cassegrain mirror-lens ("catadioptric") optical design of the Model 2045 enables a 40" effective optical tube length to be compressed into an actual tube length only 10" long — and with no sacrifice whatsoever in the most demanding performance requirements. The capabilities of the instrument are essentially limited not only by the telescope, but by the acquired skills of the observer and photographer. Do take time to read this manual thoroughly so that you will be fully acquainted with the many important features of the telescope, as well as with the auxiliary equipment and accessories available for advanced applications.

## STANDARD EQUIPMENT

- 4" Schmidt-Cassegrain optical tube assembly and fork mount with pulse motor drive system
- 1 Eyepiece — MA25mm 1-1/4" O.D.
- 1 eyepiece holder/diagonal prism assembly
- 5x24mm viewfinder
- 3 thread-in tripod legs (2 fixed length legs; 1 adjustable length leg)
- Dust covers (front and rear)
- Battery pack with cord
- Hardware package

## SETTING UP THE TELESCOPE

The basic Model 2045 telescope is shipped as a completely assembled instrument. After removing he telescope from its shipping carton and carrying case, familiarize yourself with the various controls and accessories (See Fig. 1).

The eyepiece holder/diagonal prism threads directly onto the rear cell thread of the telescope and, in turn, accepts the supplied eyepiece. The 5x24 viewfinder attaches to the rear portion of the telescope with the supplied hardware (see (1), Fig. 1).

For astronomical observations, the diagonal prism provides a comfortable right-angle viewing position. Note, however, that although the image appears correctly oriented up-and-down, it is reversed left-for-right. For terrestrial observations, where a fully-corrected image orientation (both up-and-down and left-for-right) is desirable, the optional #928 45° Erect-Image Roof Prism and eye piece holder (1-1/4") should be ordered separately. The standard diagonal prism is also well-suited for many terrestrial observations. Eyepieces are held in place in the diagonal prism with a moderate tightening of the small thumbscrew.

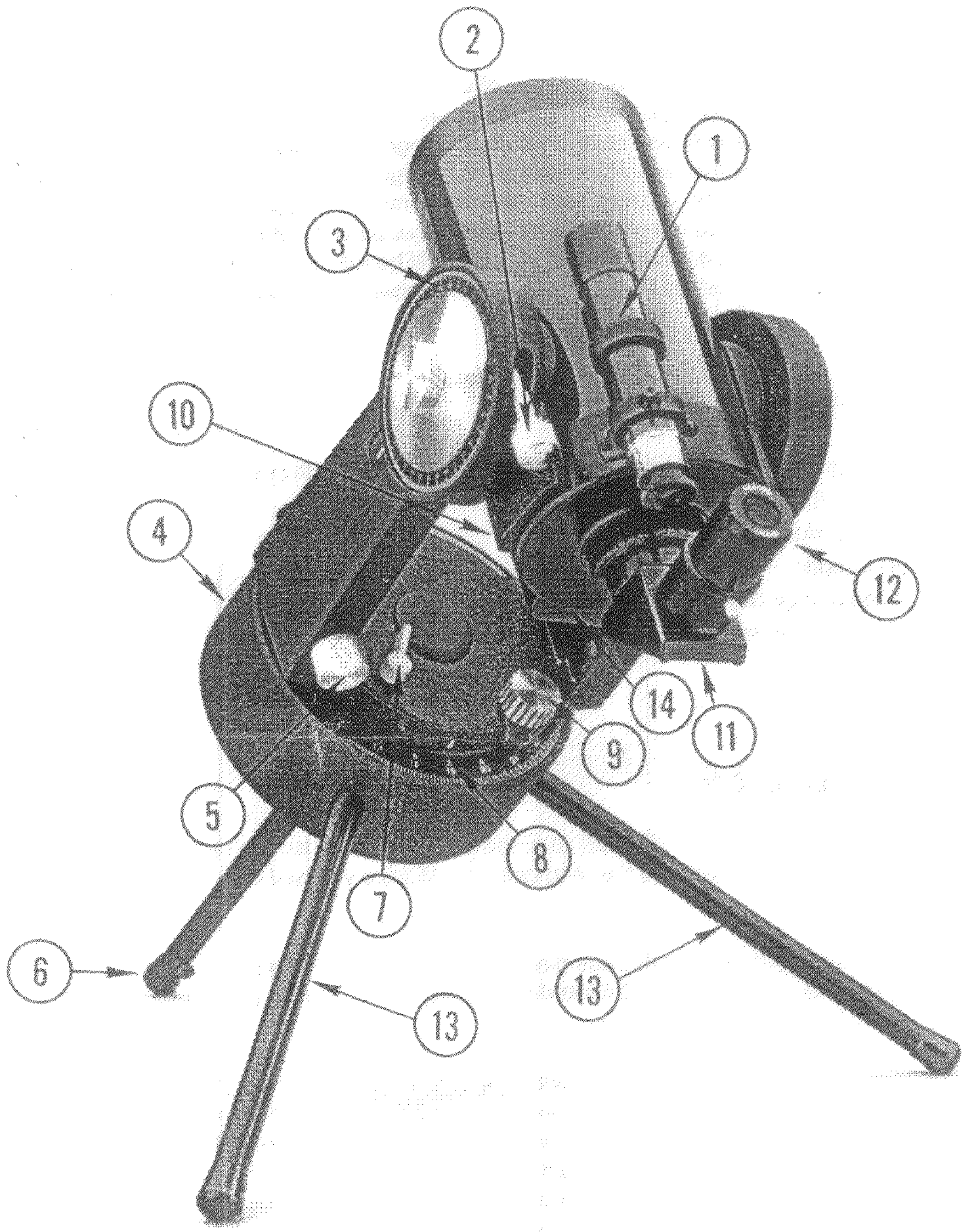



Fig. 1 — Meade Model 2045

(1) Viewfinder
(2) Declination Lock
(3) Declination Setting Circle
(4) Motor Drive Base
(5) Declination Slow-Motion Control
(6) Adjustable Tripod Leg
(7) Right Ascension Lock
(8) Right Ascension Setting Circle
(9) R.A. Slow-Motion Control
(10) Tube Adapter
(11) Eyepiece-Holder/Diagonal Prism
(12) Eyepiece
(13) Fixed-Length Tripod Leg
(14) Tripod Adapter (Optional)

## TELESCOPE OPERATION: YOUR FIRST OBSERVATIONS

With the telescope standing upright on its drive base (i.e. without the 3 tripod legs attached), the eyepiece-holder/diagonal prism attached, and with the MA 25mm eyepiece inserted into the diagonal prism, you are ready to make observations through the telescope.

**WARNING! NEVER POINT THE TELESCOPE DIRECTLY AT OR NEAR THE SUN, OR ATTEMPT TO OBSERVE THE SUN, EITHER THROUGH THE MAIN TELESCOPE OR THE VIEWFINDER, WITHOUT A PROPER PROFESSIONAL QUALITY SOLAR FILTER! INSTANT AND IRREVERSIBLE INJURY TO YOUR EYE MAY OTHERWISE RESULT!**

By unlocking the R.A. lock (7), Fig. 1, the telecope may be turned rapidly through wide angles in Right Ascension (R.A.) The reason for the terminology "Right Ascension" and its complementary term "Declination" will be made clear further on in this manual. For now, "Right Ascension" simply means "horizontal" and "Declination" means "vertical."

DO NOT ATTEMPT TO MOVE THE TELESCOPE MANUALLY IN A HORIZONTAL DIRECTION WHEN THE R.A. LOCK IS IN THE FULLY "LOCKED" POSITION, AS SUCH OPERATION MAY RESULT IN DAMAGE TO THE INTERNAL GEAR SYSTEM.

Release the Declination lock (2), Fig. 1, by rotating the control lever in a counterclockwise direction. This permits sweeping the telescope through wide angles in Declination.

DO NOT ATTEMPT TO MOVE THE TELESCOPE MANUALLY IN A VERTICAL DIRECTION WHEN THE DECLINATION LOCK IS IN THE "LOCKED" POSITION.

To use the Declination fine-adjust, or slow-motion control, lock the telescope in Declination using the Declination lock (2) Fig. 1, and turn the Declination slow-motion knob (5), Fig. 1.

NOTE THAT THIS DECLINATION SLOW-MOTION CONTROL HAS A FIXED TRAVEL LENGTH, LIMITED BY THE MOTION OF A TANGENT ARM (LOCATED INSIDE THE FORK TINE). DO NOT FORCE THE DECLINATION SLOW-MOTION KNOB WHEN THE TANGENT ARM HAS REACHED THE END OF ITS TRAVEL. IN THIS CASE, TURN THE DEC. KNOB TO RETURN THE TANGENT ARM TO THE MID POINT IN ITS TRAVEL RANGE, UNLOCK THE DECLINATION LOCK AND RE-CENTER THE TELESCOPE MANUALLY.

With the above mechanical operations in mind, select an easy-to-find terrestrial object as your first subject — for example a house or building perhaps one-half mile distant. Unlock the Dec. lock (2), Fig. 1, and R.A. lock (7), Fig. 1, center the object in the telescopic field of view and then re-lock the Dec. and R.A. locks. Precise image centering is accomplished by using the Dec. and R.A. slow motion controls (5) and (9), Fig. 1.

## FOCUSING

The focusing kob is located at the "4 o'clock" position as you face the rear cell of the telescope. Focusing is accomplsihed internally by a precise motion of the telescope primary mirror, so that as you turn the focus knob, there are no externally moving parts.

Focusing the telescope from its nearest possible focus point (on an object about 15 ft. away) to an object at infinity requires a fairly large number of rotations of the focus knob. The focuser is designed to provide an extremely sensitive means of bringing an object into precise, sharp focus. After a specific object has been brought into focus, closer objects require turning the focus knob clockwise; more distant objects require turning the focus knob counterclockwise.

It is possible that you may notice a very slight shifting of the image as you focus, particularly at high powers. This image shift is caused by very small lateral motions of the primary mirror as it moves toward or away from the secondary mirror during the focusing procedure.

## MAGNIFICATION

The magnification, or power, of the telescope depends on two optical characteristics: the focal length of the main telescope, and the focal length of the eyepiece used during a particular observation. The focal length of the Model 2045 telescope is fixed at 1000mm. To calculate the power in use with a particular eyepiece, divide the focal length of the eyepiece into the focal length of the main telescope. For example, using the MA 25mm eyepiece supplied with the Model 2045, the power is calculated as follows:

$$\text{Power} = 1000\text{mm} \div 25\text{mm} = 40\text{X}$$

Similarly, with an MA 9mm eyepiece, a magnifying power of 1000mm/9mm, or 111X, results. The type of eyepiece (whether "MA" Modified Achromatic, "OR" Orthoscopic, "SP" Super Plossl, etc.) has no bearing on magnifying power but does affect such optical characteristics as field of view, flatness of field and color correction.

When beginning observations on a particular object, start with a low-power eyepiece. Get the object well centered in the field of view and sharply focused. Then try the next step up in magnification. If the image starts to become fuzzy as you work into higher magnifications, then back down to a lower power. The atmospheric steadiness is not sufficient to support high powers at the time you are observing. Keep in mind that a bright, clearly resolved but small image will show far more detail than a dimmer, poorly resolved larger image.

Optional eyepieces and the #126 2X Telenegative Amplifier are available for higher and lower powers through the telescope.

## THE VIEWFINDER

The 5x24mm viewfinder has been prefocused at infinity. Should this focusing need adjustment for your eye, loosen the knurled collar at the objective lens end of the viewfinder (the end opposite where you observe through the finder), enabling rotation of the objective lens cell, forward or backward for precise focusing. Tighten down the knurled collar against the objective lens cell to lock the focus in place. Note that no focusing is possible or necessary at the eyepiece end of the finder scope. The viewfinder will require alignment, or collimation, to the main telescope. Using the supplied 25mm eyepiece, point the main telescope at some easy to find land object (e.g. the top of a telephone pole or corner of a building) at least 200 yards distant. Center a well-defined object in the main telescope. Then, using one of the hex wrenches provided, tighten or loosen, as appropriate, the 3 collimation screws located on the finder's rear bracket ring until the cross hairs of the finder are precisely centered in the main telescope. With this collimation accomplished, objects located first in the wide-field viewfinder will then be centered in the main telescope's field of view. Note that images seen in the viewfinder are upside-down from their counterparts viewed through the main telescope with diagonal prism.

## CELESTIAL COORDINATES

For terrestrial observing, setting the Model 2045 flat on the bottom of its drive base is a completely satisfactory method for tracking or observing objects in the telescope. For astronomical observing, however, the situation is quite different: objects move fairly rapidly through the field of view (due to Earth's axial rotation) and they move at an angle to the horizon, depending on the observer's latitude. It is for these reasons that the Model 2045 is equipped with two highly convenient features: a means of tilting the entire telescope to an angle (thereby facilitating astronomical tracking); and an electronic pulse motor drive for automatic tracking. Before discussing these points, some background in celestial coordinates is required.

Analogous to the Earth-based coordinate system of latitude and longitude, celestial objects are mapped according to a coordinate system on the "celestial sphere," the imaginary sphere on which all stars appear to be placed.

The Poles of the celestial coordinate system are defined as those two points where the Earth's rotational axis, if extended to infinity North and South, intersect the celestial sphere. Thus, the North Celestial Pole is that point in the sky where an extension of the Earth's axis through the North Pole intersects the celestial sphere. In fact, this point in the sky is located near the North Star, Polaris.

On the surface of the Earth, "lines of longitude" are drawn between the North and South Poles. Similarly, "lines of latitude" are drawn in an East-West direction, parallel to the Earth's equator. The celestial equator is simply a projection of the Earth's equator onto the celestial sphere. Just as on the surface of the Earth, imaginary lines have been drawn on the celestial sphere to form a coordinate grid. Celestial object positions are mapped on this grid in the same manner as positions on the Earth's surface are specified by their latitude and longitude.

The celestial equivalent to Earth latitude is called "Declination," or simply "Dec.," and is measured in degrees, minutes and seconds North ("+") or South ("-") of the celestial equator. Thus any point on the celestial equator (which passes, for example, through the constellations Orion, Virgo and Aquarius) is specified as having $0°0^{min}0^{sec}$ Declination. The Declination of the star Polaris, located very near the North Celestial Pole, is +89.2°.

The celestial equivalent to Earth longitude is called "Right Ascension," or "R.A.," and is measured in hours, minutes and seconds from an arbitrarily defined "zero" line of R.A. passing through the constellation Pegasus. Right Ascension coordinates range from $0^{hr}0^{min}0^{sec}$ up to (but not including) $24^{hr}0^{min}0^{sec}$. Thus there are 24 primary lines of R.A., located at 15° intervals along the celestial equator. Objects located further and further East of the prime ($0^{hr}0^{min}0^{sec}$) Right Ascension grid line carry increasing R.A. coordinates.

With all celestial objects therefore capable of being specified in position by their celestial coordinates of Right Ascension and Declination, the task of finding objects (in particular faint objects) in the telescope is greatly simplified. The setting circles of the Model 2045 may be dialed, in effect, to read the object-coordinates, and the object found without resorting to visual location techniques. However, these setting circles may be used to advantage only if the telescope is first properly aligned with the North Celestial Pole.

## LINING UP WITH THE CELESTIAL POLE

Objects in the sky appear to revolve around the celestial pole. (Actually, celestial objects are essentially "fixed," and their apparent motion is caused by the Earth's axial rotation). During any 24-hour period, stars make one complete revolution about the Pole, describing concentric circles with the Pole at the center. By lining up with the telescope's polar axis with the North Celestial Pole (or, for observers located in the Earth's Southern Hemisphere, with the South Celestial Pole), astronomical objects may be followed, or tracked, simply by moving the telescope about **one** axis, the polar axis. In the case of the Meade Model 2045, this tracking may be accomplished automatically with the electric motor drive.

For the purposes of casual visual telescopic observations, lining up the telescope's polar axis to within a degree or two of the Pole is more than sufficient. With this level of pointing accuracy, the telescope's motor drive will track accurately and keep objects in the telescopic field of view for perhaps 20 to 30 minutes.

To line up the telescope with the North Celestial Pole, follow this procedure:

1. Attach the 3 tripod legs to the telescope, as shown in Fig. 1. Note that one leg is adjustable in length. This leg should be threaded into the central hole on the underside of the drive base.

2. The polar axis of the telescope is an imaginary line running through the adjustable tripod leg, up through the center of the drive base, and up between and parallel to the two fork arms. The long arrow in Fig. 2 indicates the polar axis. (It is around this axis that the telescope turns in Right Ascension). In Fig. 2, the telescope is oriented so that the main optical tube is also aligned with the polar axis. With the telescope

position as in Fig. 2 (careful eye alignment to make the main tube parallel to the fork arms is sufficient), perform these two operations:

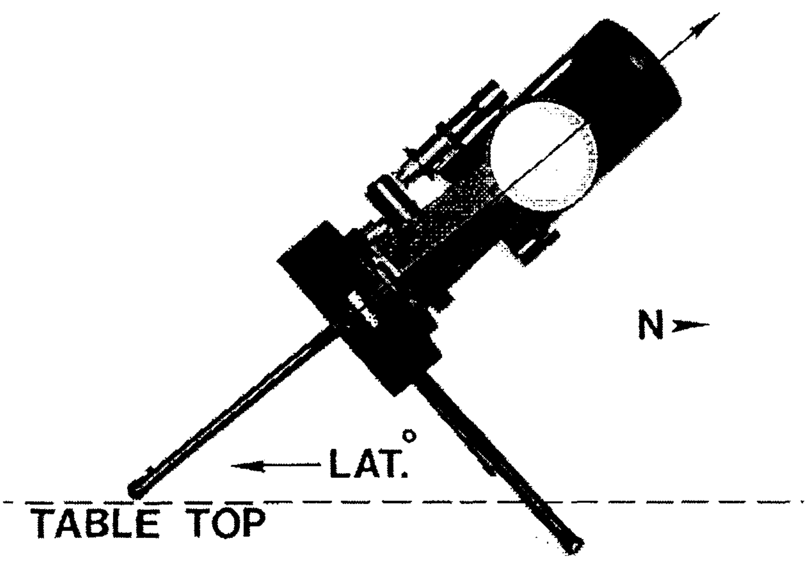
a. Turn the entire telescope on its tripod **until the telescope tube is pointing due North.**

b. Lengthen or shorten the adjustable tripod leg (6), Fig. 1, **until the angle it makes with the horizontal is equal to your latitude.** (Most road maps show latitude). Use a protractor for this operation: hold the protractor up to the tripod leg and adjust the leg length until the leg angle to the horizontal equals your latitude.

In Fig. 2, note that the telescope is pointing North and the adjustable tripod leg has been set to make the correct latitude angle with the horizontal as described in steps (a) and (b). The adjustable leg is locked to the correct length by tightening the small thumbscrew located at the lower end of the leg.

The above procedure is approximate, but is more than adequate for visual observations through the telescope and for many astrophotographic applications.

If the polar alignment procedure has been properly performed, then the North Star (Polaris) will be visible in the field of view of the viewfinder, with the telescope again oriented as shown in Fig. 2. In summary, the polar axis is indicated by the long arrow lined up with the adjustable tripod leg. This axis should (a) point North; (b) make an angle with the tabletop (horizontal) equal to your latitude. To accomplish (b), lengthen or shorten the adjustable tripod leg




**.Figure 2: Lining Up With The Pole**

With the telescope thus aligned to the Pole, the position of the tripod remains fixed during all subsequent observations through the telescope. Loosen the R.A. and Dec. locks each time you wish to move the telescope manually to locate a new object, then re-tighten these locks once the object is in the telescopic field of view. When the electronic pulse motor drive is plugged in, the telescope automatically tracks astronomical objects each time you re-tighten the R.A. lock.

As a separate procedure, during your first use of the telescope, you should check the calibration of the Declination setting circles (see (3), Fig. 1), located at the top of the two fork arms. With Polaris in the field of the viewfinder or in the field of the main telescope if properly polar aligned, loosen slightly the knurled central hubs of both Declination setting circles. Now turn each circle until each reads 89.2°, the Declination of Polaris, and then tighten down the knurled knob, avoiding any motion of the circle.

Once the correct length of the adjustable tripod length for proper polar alignment has been determined,make a small mark on the tripod leg indicating the proper leg extension position. The tripod leg may now be extended to the correct position without resorting to the entire procedure above. Simply point the polar axis due North and extend the tripod leg to the pre-marked location. If you move your observing location significantly, you will need to re-set the tripod to the correct angle. (Approximately 70 miles movement in North-South observing position is equivalent to 1° in latitude change.)

## LATITUDE RANGES

Note that the adjustable leg may be varied in length to accommodate a wide range of observing location latitudes. In addition, this tripod leg may be threaded into any one of three holes on the underside of the drive base to achieve an even wider range of latitude angles.

If the adjustable tripod leg is threaded into the top mounting hole (on the underside of the drive base), then the adjustable leg covers a latitude range of from 32° to 49°; in the middle (central) hole, it covers a range from 27° to 42°; and in the bottom hole, it covers a range from 21° to 34°.

## HIGH LATITUDES

At high latitudes, the standard equipment adjustable tripod leg may not permit a sufficiently high angle for the polar axis to be in correct alignment. In this case (at latitudes higher than about 49°) the optional "Center Tripod Leg for High Latitudes" (47° to 69°) should be used. The high latitude adjustable leg can be used for latitudes from 47° to 69° as follows: with the leg in the top mounting hole, the latitude range is 60° to 69°; in the middle (central) hole, the range is from 53° to 64°; and in the bottom hole, the range is from 47° to 56°.

## LOW LATITUDE BALANCE WEIGHT

When the Model 2045 is used at low latitudes, the telescope is tilted to a large angle. At such an angle, the telescope may become unstable and the adjustable tripod leg may tend to lift off of the tabletop. To prevent this instability at lower latitudes, the optional Low Latitude Balance Weight is available.

Unthread the adjustable tripod leg from its position in the drive base and slide the Low Latitude Balance Weight onto the tripod leg. This balance weight should be placed on the adjustable tripod leg as close to the lower (rubber tip) end of the leg as possible. After positioning the balance weight, fix it in position by a moderate tightening of its thumb screw.

The Low Latitude Balance Weight is recommended whenever the observing location is at ***30° latitude or lower*** for visual observations or when the telescope is being used with a camera attached, at observing latitudes of ***35° or lower***.

## PRECISE POLAR ALIGNMENT

Unless you intend to engage in long exposure astrophotography, it is not necessary to follow the precise polar alignment procedure described in this section.

Notwithstanding the precision and sophistication of the quartz time base drive system supplied with the Meade Model 2045, the fewer tracking corrections required during the course of a long-exposure photograph, the better. (For our purposes, "long-exposure" means any photograph of about 10 minutes duration or longer). In particular, the number of Declination corrections required is a direct function of the precision of polar alignment.

The procedure described here should be implemented only after the alignment procedures of the preceding section have first been carried out.

Precise polar alignment requires the use of a cross hair eyepiece. The Meade MA 12mm Illuminated Reticle Eyepiece is well-suited in this application, but you will want to increase the effective magnification through the use of the #126 2X Telenegative Amplifier. Then follow this procedure:

1. Place the illuminated reticle eyepiece (or eyepiece/Telengegative Amplifier combination) into the diagonal prism of the telescope.

2. Point the telescope with the motor drive running, at a moderately bright star near where the meridian (the North-South line passing through your local zenith) and the celestial equator intersect. For best results, the star should be located within ± 30 minutes in R.A. of the meridian and within ± 5° of the celestial equator.

3. Note the extent of the star's drift in Declination (disregard drift in Right Ascension):
   a. If the star drifts South, the telescope's polar axis is pointing too far East.
   b. If the star drifts North, the telescope's polar axis is pointing too far West.

4. Carefully move the table tripod of the Model 2045 to effect the appropriate change in polar alignment. Reposition the telescope's East-West polar axis orientation until there is no further North-South drift by the star. Track the star for a period of time to be certain that its Declination drift has ceased.

5. Next, point the telescope at another moderately bright star near the Eastern horizon, but still near the celestial equator. For best results, the star should be about 20° or 30° above the Eastern horizon and within ± 5° of the celestial equator.

6. Again note the extent of the star's drift in Declination:
   a. If the star drifts South, the telescope's polar axis is pointing too low.
   b. If the star drifts North, the telescope's polar axis is pointing too high.

7. Change the extension length of the adjustable tripod leg to effect the appropriate corrections in latitude angle. Again track the star for a period of time to be certain that Declination drift has ceased.

The above procedure results in very accurate polar alignment, and minimizes the need for tracking corrections during astrophotography.

The optional Meade Equatorial Wedge/Field tripod system provides an extremely stable platform for the most discriminating long exposure photography and also permits standing observations through the telescope in the equatorial mode.

## ELECTRONIC MOTOR DRIVE

Supplied as standard equipment with the Model 2045 is an extremely accurate drive gear drive system, driven by a precision pulse motor. The power cord from the battery pack plugs into the bottom of the telescope's drive base. The North-South switch, located on the bottom plate of the drive base (see (4), Fig. 1), reverses the motor drive direction, thus permitting use of the telescope in both the Northern and Southern hemispheres.

With the telescope set up in the equatorial mode (as described above under "Lining Up with the Pole"), plug the power cord into the drive base. Immediately, if you put your ear to the drive base of the telescope, you will be able to hear the low level noise created by the running motor. The drive system turns the fork mount of the telescope through one complete revolution every 24 hours, and results in the stars "standing still" as you view them through the telescope eyepiece. The motor drive also drives the R.A. setting circle, (see (8) Fig. 1), as described in the next section.

The motion of the telescope caused by the drive system is not obvious if you look at the telescope (in fact, it is not even perceptible). However, while observing through the telescope, it is a very significant motion indeed. To check this point, with a star centered in the telescope field and the electric motor drive running, unplug the power cord: the star will immediately begin to drift out of the field of view; at higher powers, the effect is even more pronounced.

The motor drive is engaged by turning the R.A. lock (see (7), Fig. 1) to the locked position. Simply "unlock" the R.A. lock to disengage the motor drive when manually pointing the telescope at another object.

NOTE: DO NOT ATTEMPT TO TURN THE R.A. SLOW-MOTION CONTROL KNOB WHEN THE R.A. LOCK IS IN THE "LOCKED" POSITION. SUCH AN OPERATION WILL CAUSE INTERNAL DAMAGE TO THE GEARS OF THE R.A. SLOW-MOTION CONTROL. IN ADDITION, DO NOT ATTEMPT TO TURN THE TELESCOPE MANUALLY ON ITS FORK MOUNT IN R.A. WHEN THE R.A. LOCK IS "LOCKED," AS SUCH OPERATION WILL CAUSE RAPID WEAR OF THE INTERNAL CLUTCH SYSTEM.

## SETTING CIRCLES

Setting circles included with the Model 2045 permit the location of faint celestial objects not easily found by direct visual observation. Located on the top surface of the telescope's drive base, the R.A. circle (7), Fig. 1, is 6" (15cm) in diameter. The Declination circles (see (3), Fig. 1), are located on top of each fork tine. With the telescope pointed at the North Celestial Pole, the Dec. circle should read 90° (understood to mean +90°). Objects located below the 0-0 line of the Dec. circle carry minus Declination coordinates. Each division of the Declination circle represents a 1° increment. The R.A. circle runs from $0^{hr}$ to (but not including) $24^{hr}$, and reads in increments of $5^{min}$.

Note that the R.A. circle of the Model 2045 is double-indexed: the upper line of numbers (running clockwise from 0 to 23) should be used by observers in the Earth's **Southern** Hemisphere (e.g. Australia); the lower line of numbers (running counterclockwise from 0 to 23) should be used by observers in the Earth's **Northern** Hemisphere (e.g. the U.S.A.).

With the telescope aligned to the pole, center an object of known R.A. in the telescopic field. Then turn the R.A. circle, which can be rotated manually by moderate thumb pressure, until the R.A. coordinate of the object is correctly indicated by the R.A. pointer. As long as the telescope's motor drive remains "ON," the R.A. pointer will then correctly indicate the R.A. of any object at which the telescope is pointed throughout the duration of the observing session.

To use the circles to locate a particular object, first look up the celestial coordinates (R.A. and Dec.) of the object in a star atlas. Then loosen the R.A. lock and turn the telescope to read the correct R.A. of the desired object; lock the R.A. lock onto the object. Next, turn the telescope in Declination to read the correct Declination of the object. If the procedure has been followed carefully, and if the telescope was was well-aligned with the pole, the desired object should now be in the telescopic field of a low-power eyepiece.

If you do not immediately see the object you are seeking, try searching the adjacent sky area, using the R.A. and Dec. slow-motion controls to scan the surrounding region. Keep in mind that, with the 25mm eyepiece, the field of view of the Model 2045 is about 1°. Because of its much wider field, the 5x24mm viewfinder may be of significant assistance in locating and centering objects, after the setting circles have been used to locate the approximate position of the object.

Pinpoint application of the setting circles requires that the telescope be precisely aligned with the pole. Refer to the preceding section on "Precise Polar Alignment" for further details.

## OBSERVING WITH THE TELESCOPE

The Meade Model 2045 4" Schmidt-Cassegrain telescope permits an extremely wide array of serious observational opportunities. Even in normal city conditions, with all of the related air and light polution, there are many interesting celestial objects to observe. But to be sure, there is no substitute for the clear, steady dark skies generally found away from urban environments or on mountaintops. Objects previously viewed only in the city take on added detail, are seen in wider extension, or fainter objects become visible for the first time.

The amateur astronomer is faced with two broadly defined problems when viewing astronomical objects through the Earth's atmosphere: first is the clarity, or **transparency** of the air, and second, the **steadiness** of the air. This latter characteristic is often referred to as the quality of "seeing." Amateur astronomers talk almost constantly about the "seeing conditions," since, ironically, even the clearest, darkest skies may be almost worthless for serious observations if the air is not steady. This steadiness of the atmosphere is most readily gauged by observing the "twinkling" of the stars: rapid twinkling implies air motion in the Earth's atmosphere, and under these conditions, resolution of fine detail (on the surface of Jupiter, for example) will generally be limited. When the air is steady, stars appear to the naked eye as untwinkling points of unchanging brightness, and it is in such a situation that the full potential of the telescope may be realized: higher powers may be used to advantage, closer double stars resolved as distinct points and fine detail observed on the Moon and planets.

Several basic guidelines should be followed for best results in using your telescope:

1. Try not to touch the eyepiece while observing. Any vibrations resulting from such contact will immediately cause the image to move.

2. Allow your eyes to become "dark adapted" prior to making serious observations. Night adaptation generally requires about 10 to 15 minutes for most people.

3. Let the telescope "cool down" to the outside environmental temperature before making observations. Temperature differentials between a warm house and cold outside air require about 30 minutes for the telescope's optics to regain their true and correct figures. During this period, the telescope will not perform well. A good idea is to take the telescope outside 30 minutes before you want to start observing.

4. If you wear glasses and do not suffer from astigmatism, take off your glasses when observing through the telescope. You can re-focus the image to suit your own eyes. Observers with astigmatism, however, should keep their glasses on since the telescope cannot correct for this eye defect.

5. Avoid setting up the telescope inside a room and observing through an open window (or, worse yet, through a closed window). The air currents caused by inside/outside temperature differences will make quality optical performance impossible.

6. Perhaps most importantly of all, avoid "overpowering" your telescope. The maximum usable magnification at any given time is governed by the seeing conditions. If the telescopic image starts to become fuzzy as you increase power, drop down to a reduced magnification. A smaller but brighter and sharper image is far preferable to a larger but fuzzy and indistinct one.

7. As you use your telescope more and more, you will find that you are seeing finer detail: observing through a large aperture telescope is an acquired skill. Celestial observing will become increasingly rewarding as your eye becomes better trained to the detection of subtle variations of resolution.

## TELESCOPE MAINTENANCE

Cleaning the Optics

Perhaps the most common telescope maintenance error is cleaning the optics too often. A little dust on the surface of the front correcting lens causes negligible degradation of optical performance; don't clean the outside surface of this lens unless really necessary. To remove small particles on the corrector lens surface, use a camel's hair brush (gently!) or blow off with an ear syringe (available from a local pharmacy). If further cleaning is required, a photographic lens cleaner may be used. In any case, do not clean the correcting lens by taking strong circular wipes with a piece of cloth or other material. Use a **white** Kleenex-type tissue and make short, gentle radial wipes (from the center outward). Change tissues several times when cleaning the entire lens surface.

Since all Model 2045 telescopes include a high-transmission magnesium fluoride coating on the correcting lens, always take care during cleaning to avoid scratching this coating.

To clean the inside surface of the correcting lens, the entire correcting lens cell may be unthreaded from the blue color main tube. Follow the same procedure to clean the inside lens surface as described above and then re-thread the entire corrector lens in cell carefully back onto the blue main tube. **Do not touch or attempt to clean the secondary mirror surface, as scratches will almost certainly result!** (The secondary mirror is visible in the center of the correcting lens, when the correcting lens cell is unthreaded

from the main tube).
Importantly, do not remove the actual correcting lens from its machined cell housing for cleaning or other purposes. You will almost certainly not be able to replace the correcting lens in its proper rotational orientation, and serious degradation of optical performance may result.

Alignment of the Optical System

All Meade Schmidt-Cassegrain telescopes are precisely collimated (aligned) at the factory before packing and shipment, and it is probable that you will not need to make any optical adjustments before making observations. However, if the telescope sustained rough handling in shipment, you may need to recollimate the optical system. Such recollimation is not difficult, in any case.

To check the collimation of your telescope, locate in the telescope a moderately bright (first or second magnitude) star near the zenith. To perform the test, center the starpoint in the telescopic field with a low power eyepiece, such as the 25mm eyepiece supplied as standard equipment. Defocus the image to fill about 1/4 of the field of view. You will see in the out-of-focus image a circle of light with the darker circular shadow of the secondary mirror somewhere within. If the darker shadow is well centered within the lighter shadow(see (C), Fig. 4), your telescope is well collimated, but continue to read this section for the more sensitive, high power tests to be described below. If the darker shadow is **not** so centered (see (A), Fig. 4), follow this procedure:

1. Locate the three collimation set screws near centrer portion of the front corrector plate lens (see Fig. 3).

2. Note that the only optical alignment adjustment of the Model 2045 that is ever necessary or possible is the tilt-angle adjustment of the secondary mirror. Adjustment of this tilt-angle is achieved by turning the 3 set screws (2), (3) and/or (4) in Fig. 3, located at the edge of the secondary mirror housing.

DO NOT AT ANY TIME TURN OR ADJUST THE CENTER SCREW (SEE (1), FIG. 3), LOCATED ON THE OUTER SURFACE OF THE SECONDARY MIRROR HOUSING. THIS SCREW HOLDS THE SECONDARY MIRROR IN PLACE IN ITS HOUSING!

DO NOT FORCE THE 3 COLLIMATION SET SCREWS PAST THEIR NORMAL TRAVEL AND BE SURE TO KEEP AT LEAST ONE SCREW UNDER TENSION AT ALL TIMES SO THAT THE SECONDARY MIRROR WILL NOT ROTATE IN ITS HOUSING. NOTE THAT THE SECONDARY MIRROR COLLIMATION ADJUSTMENTS ARE VERY SENSITIVE: GENERALLY, TURNING A SET SCREW 1/2 TURN WILL HAVE DRAMATIC EFFECTS ON COLLIMATION.

3. While observing the defocused star image, note the direction in which the darker shadow is offset within the lighter circle. Using the telescope's slow-motion controls, move the defocused image to the edge of the field of view, in the same direction as the darker shadow is offset.

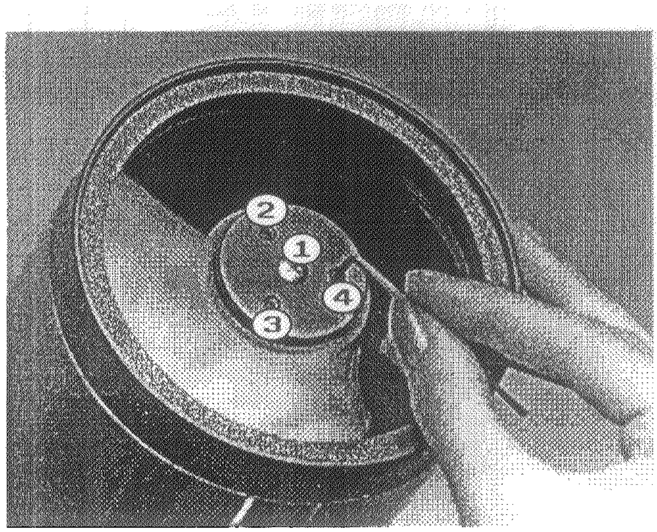



**Fig. 3: Collimation of the Optical System**

4. Tighten the screw or screws in the same direction as the darker shadow is off-center and loosen the other screw or screws. Continue this process until the defocused image is brought back to the center of the telescopic field. If, after following these steps, the secondary mirror shadow is still off-center in the out-of-focus star image, repeat procedures until the shadow is exactly centered.

5. Now proceed to a higher power (e.g. 9mm) eyepiece and repeat steps 3 and 4. Any lack of concentricity at this point will require only extremely slight adjustments of the 3 set screws.

6. As a final check on collimation, examine the star focus image in-focus with a fairly high power (9mm or shorter focal length) eyepiece, under good seeing conditions. The starpoint should appear as a small central dot (the so called "Airy disc") with one diffraction ring surrounding it. Make very small adjustments of the 3 set screws, if necessary, to center the Airy disc in the diffraction ring. With this final adjustment performed, the telescope is collimated.

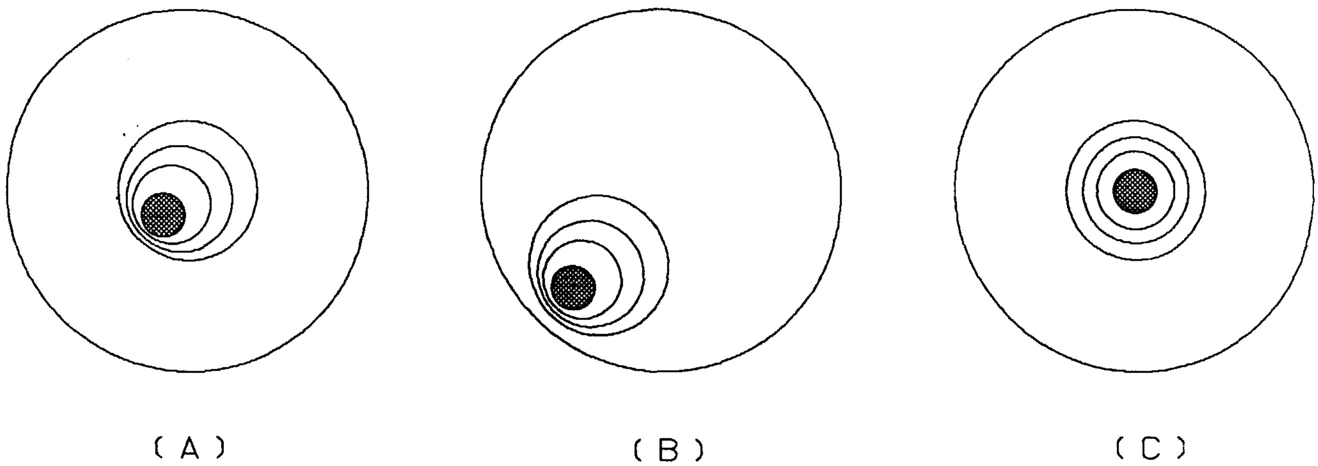



**Fig. 5: Summary of the Collimation Procedure**
(a) Note if the darker shadow is decentered, as shown, inside the lighter circles; (b) use the telescope's controls to move the image to the edge of the field in the same direction as the darker shadow is off center; (c) tighten and/or loosen, as appropriate, the secondary housing's 3 collimation set screws to bring the image back to the center of the field; repeat (a) and (b), if necessary.

The Meade Model 2045 has been designed and manufactured for years of trouble free operation and repairs should rarely be necessary. If a problem does occur, first write or call our Customer Service Department. Do not return the telescope for servicing until you have communicated with us in this way, since the great majority of problems can be handled without return of the telescope to us. When telephoning or writing, please explain in detail the exact nature of the problem so that we may offer a prompt remedial procedure. Be sure to include your full name, address and phone number.

## BASIC SPECIFICATIONS:
## MODEL 2045 4" (102MM) SCHMIDT-CASSEGRAIN TELESCOPE

| | |
|---|---|
| Optical Design | Schmidt-Cassegrain Catadioptric |
| Clear Aperture | 102mm (4") |
| Focal Length | 1000mm (40") |
| Focal Ratio (Photographic Speed) | f/10 |
| Near Focus (approx.) | 15 ft. |
| Resolution | 1.1 arc secs. |
| | 188 lines per mm |
| Limiting Visual Magnitude | 12 |
| Limiting Photographic Magnitude | 14.5 |
| Image Scale | 1.43 degs./inch |
| Maximum Practical Visual Power | 300X |
| 35mm Film Coverage at Distances of: | |
| 50 ft. | 13.3" x 19.6" |
| 500 ft. | 11.8' x 17.3' |
| 3000 ft. | 70.5' x 103.5' |
| 35mm Angular Film Coverage | 1.38° x 1.96° |
| Telescope Mounting | Fork-type, double tine |
| Electronic Motor Drive | 12Vdc Pulse Motor |
| Setting Circle Diameters | Dec.: 4"; R.A.: 6" |
| Manual Slow-Motion Controls | Dec. and R.A. |
| Standard Accessories | |
| Setting Circles | |
| Dust Covers | |
| Viewfinder | 5x24mm |
| Eyepiece | 1.25" O.D. 25mm (40X) |
| Eyepiece Holder/Diagonal Prism | Accepts 1.25" O.D. eyepieces |
| Tripod Legs (tabletop) | 2 pcs. Fixed Length |
| | 1 pc. Adjustable length |
| Battery Pack with Power Cord | |
| Powers Obtained with Optional Eyepiece (**Note 1**): | |
| 4mm | 250X (500X) |
| 6mm | 167X (333X) |
| 9mm | 111x (222x) |
| 12.5mm | 80X (160X) |
| 18mm | 56X (112X) |
| 40mm | 25X (50X) |
| Optical Tube Size | 4.6" Dia. x 10" Long |
| Secondary Mirror Obstruction | 1.8" Dia.: 20% |
| Materials and Construction | |
| Tube Body | All Aluminum |
| Mirrors | Pyrex Glass |
| Telescope Size, Swung Down | 7" x 9" x 16" |
| Carrying Case Dimensions | 17" x 10" x 11" |
| Net Telescope Weight (approx.) | 12 lbs. |
| Shipping Weight (approx.) | 16 lbs. |

NOTES:

(1) Numbers in parenthesis indicate Magnifying Powers when the specified eyepiece is used in conjunction with the #126 2X Telenegative Amplifier. Note that, in any case, powers in excess of about 300X on the Model 2045 may be used to advantage only under the very best observing conditions.